

## **Papahānaumokuākea Marine National Monument Permit Application Cover Sheet**

This Permit Application Cover Sheet is intended to provide summary information and status to the public on permit applications for activities proposed to be conducted in the Papahānaumokuākea Marine National Monument. While a permit application has been received, it has not been fully reviewed nor approved by the Monument Management Board to date. The Monument permit process also ensures that all environmental reviews are conducted prior to the issuance of a Monument permit.

### **Summary Information**

**Applicant Name:** Bowen, Brian W.

**Affiliation:** Hawaii Institute of Marine Biology

**Permit Category:** Research

**Proposed Activity Dates:** 5/15/08 - 9/15/08

**Proposed Method of Entry (Vessel/Plane):** RV Hi'ialakai

**Proposed Locations:** Shallow water habitats (< 200 feet depth), focused on Kure, Midway, Pearl & Hermes, and Nihoa. However, we request latitude to sample other regions as weather and opportunity dictate.

**Estimated number of individuals (including Applicant) to be covered under this permit:**

16

**Estimated number of days in the Monument:** 54

**Description of proposed activities:** (complete these sentences):

a.) The proposed activity would...

be a genetic survey of reef fishes, designed to address the level of isolation between reef ecosystems across the Hawaiian Archipelago, and especially throughout the Papahānaumokuākea Marine National Monument.

A new aspect of the project is that we will use DNA technology to examine a parasite that may have been accidentally introduced in the 1950's. This parasitic nematode, *Spirocamallanus istiblenni*, apparently hitchhiked to Hawaii with the blueline snapper *Lutjanus kasmira* and has subsequently spread to native fishes. While the introduction occurred on Oahu, the parasite has been detected in the Monument but has an uncertain distribution.

b.) To accomplish this activity we would ....

survey approximately 30 fish species at locations across the entire archipelago, using polespears and traps to collect fish, and using mtDNA sequencing technology to resolve connectivity among reef habitats.

c.) This activity would help the Monument by ...  
determining whether the Monument is a series of relatively fragile (isolated) ecosystems, or whether individual reef habitats are connected in a larger and more robust ecosystem. There is also a concern about whether the NWHI serves as a source of larvae to replenish depleted fisheries in the main Hawaiian Islands. The assays of population connectivity outlined here will address these issues in a format that has statistical power and scientific credibility.

**Other information or background:** To preserve biodiversity, it is important to know how it is arises (Bowen and Roman 2005). While the main objective is to assess genetic connectivity among shallow reef habitats, a “value added” component is that we can assess the age and origin of Hawaiian fauna as well as the age and origins of populations on each island. A genealogical approach to relationships among mtDNA haplotypes will indicate whether the closest relatives to the Hawaiian fauna lie predominantly to the West (Ogasawara Arch, Wake Island, or Marshall Islands) or to the South (Johnston Atoll, Line Islands; Gosline 1955; Maragos and Jokiel 1986; Maragos et al. 2004). In these cases, populations of the widespread Indo-Pacific species will be compared to the Hawaiian endemic. The geographic source of the Hawaiian form (especially Hawaiian endemics) will be resolved with parsimony networks and phylogenetic tools (see Methods), and the age of colonization events will be estimated with the mtDNA molecular clock.

Reef fauna typically have a pelagic phase (eggs and larvae), which lasts 20-60 days, followed by settlement onto a reef where they remain through juvenile and adults stages. Long distance dispersal is accomplished almost exclusively during the pelagic larval phase. However, the geographic limits of such dispersal are uncertain (Bowen et al. 2006a; 2006b). Recent research shows that effective dispersal of marine larvae can fall short of their potential (Swearer et al. 2002). These findings set the stage for a methodical range-wide survey of reef faunas in the Hawaiian archipelago.